BIOLOGICAL EVALUATION/BIOLOGICAL ASSESSMENT
for
THREATENED, ENDANGERED, SENSITIVE PLANT AND FUNGI SPECIES

Somes Bar Integrated Fuels Management Project
Orleans/Ukonom Ranger Districts

SIX RIVERS NATIONAL FOREST

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Somes Bar Integrated Fuels Project

I. INTRODUCTION

The objectives of this biological assessment and evaluation are (a) to determine the effects of a fuels management project on any Threatened, Endangered, Sensitive plant or fungi species and (b) to insure these species receive full consideration in the decision-making process to maintain species viability (FSM 2672.4).

McDonald's rock-cress (*Arabis macdonaldiana*) is the only Federally listed species on the Forest (USFWS 2015). On Six Rivers, McDonald's rock-cress is known only to Del Norte County and occupies barrens and rock outcrops primarily comprised of serpentinite bedrock. A serpentine band occurs in the project area, however, based upon field inspection, the habitat is dominated by buckbrush (*Ceanothus cuneatus*) shrub fields with scattered Jeffrey pine-California Fescue stands—habitat types that are not known to support McDonald's rock-cress. Since habitat for this species is lacking in the project, this species will not be further analyzed.

II. CURRENT MANAGEMENT DIRECTION

Current policy for Sensitive plants as stated in the Forest Service Manual includes the following:

- Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands (USDA/USFS 2005, FSM 2670.22).

- Avoid or minimize impacts to species whose viability has been identified as a concern (USDA/USFS 2005 FSM 2670.32).

If impacts cannot be avoided, analyze the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole. (The line officer, with project approval authority, makes the decision to allow or disallow impact, but the decision must not result in loss of species viability or create significant trends toward Federal listing. FSM 2670.32)

In keeping with the manual direction, the respective Forest Plans for the Klamath National Forest and the Six Rivers include the following:

Six Rivers Standards and Guidelines (USDA/USFS 1995):

- 6-2 pg. 83. Before the NEPA process is completed, projects will be assessed through a biological evaluation to determine if management activities are likely to adversely affect sensitive plant resources. After completion of .the evaluation,

proposed actions will be prohibited if they are found likely to jeopardize the continued existence of the species or the maintenance of the viable populations throughout their existing range. Appropriate mitigation measures will be required if activities are not prohibited.

Klamath Standards and Guidelines (USDA 2010), Section 7 pg. 27:

- management activities should imitate the natural ecological processes that created Sensitive habitat,
- fire and timber management can be used as tools for meeting this intent

IV. EXISTING ENVIRONMENT

Habitat Characteristics

The primary vegetation sub-series[1] in the project area are: Tanoak-Chinquapin, Tanoak-Black Oak, Tanoak-Evergreen Huckleberry, Tanoak- Big Leaf Maple, Tanoak-Canyon Live Oak, Douglas-fir-Black Oak and Douglas-fir-Canyon Live Oak. Tanoak-Canyon live oak and Douglas-fir-Canyon live oak were the most common vegetative types in the project area. Elevation ranges from approximately 900' near the Klamath River to 2800' and seral stages range from pole/early mature to late-mature.

A species list for the units is included in the administrative file.

Sensitive Species

The pre-field analysis included review of the Forest Sensitive database and associated spatial layers of known occurrences relative to the project area, assessment of the vegetative sub-series and stand age in which the project occurs using the ecology vegetation classification spatial database of "Potential Natural Vegetation" and professional knowledge of Sensitive species habitat and distribution on the Forest. Table 1 displays the results of the pre-field analysis

Table 1. Sensitive Species[2] considered in the project as a result of pre-field analysis

Common Name	**Scientific Name**	**Known (K) or Potential (P)**	**Taxonomic Group**	**General Habitat**
N/A	*Buxbaumia viridis*	K	Bryophyte	Mature forest-moist, riparian
Fascicled lady's slipper	*Cypripedium fasciculatum*	P	Vascular plant	Mature forest

[1] Using the Ecology Vegetation Classification- "Potential Natural Vegetation" which includes co-dominant and indicator species, which in turn provide information about habitat conditions such as soil moisture conditions.

[2] List reflects Regional Forester's Sensitive Species List updated 2013

Mountain lady's slipper	*Cypripedium montanum*	P	Vascular plant	Mature forest
N/A	*Ptilidium californicum*	P	Bryophyte	Mature forest
None	*Sulcaria badia*	P	Lichen	Conifer or hardwood substrate; woodlands or open forest
False yellow lupine	*Thermopsis robusta*	K	Vascular plant	Early-seral, disturbed settings
Fungi				
None	*Dendrocollybia racemosa*	P	Fungus	Mature forest
None	*Boletus pulcherrimus*	P	Fungus	Mature forest
None	*Phaeocollybia olivacea*	K	Fungus	Mature forest
None	*Sowerbyella rhenana*	P	Fungus	Mature forest

In light of the potential and known Sensitive species, stratification of the project targeted for survey emphasized units with mature forest types, specifically those typed as mid-mature (without harvest), late-mature (without and with harvest), old-growth (without and with harvest). The one exception to the mature forest affiliation is the early successional species, *Thermopsis robusta* is associated with clearings and road edges—settings of periodic disturbance. Road proximity surveys were conducted independently for this species by Mid Klamath Watershed Council.

The project area is divided into four focal groups totaling 5570 acres. As a result of both the pre-field analysis and field reconnaissance, approximately 1650 of the 5570 unit acres (30%) were surveyed for vascular and non-vascular Sensitive species. Units or portions thereof not subject to survey were plantations (seral stage classified as pole-harvest, early mature with harvest) and those characterized by shrub-dominated communities, or vegetation sub-series lacking habitat components for the species in Table 1. An example of the latter were those stands with Canyon Live Oak Series or sub-series with Canyon live oak as a co-dominant species as these stands are indicative of dry conditions with high surface rock content and not considered suitable habitat for the Forest Sensitive species. The list of unit and survey status is included in the administrative file.

Surveys of most all of the units with potential habitat occurred from June 16, 2015-August 23, 2015 to capture the phenology of the vascular plants, *Cypripediums* and *Thermopsis robusta*. Surveys were not conducted for any Sensitive fungi species due to the nature of the project; the prescriptions associated with mid-mature and older stands—were primarily manual fuels treatment with prescribed burn. The prescription in association with standards and guidelines (e.g. retention of coarse woody debris) retain

habitat components for most fungi. The rationale for this decision is further explained under "Environmental Effects" below.

Surveys resulted in the finding of four sensitive species in various units (Table 2). No other Sensitive vascular or non-vascular species in Table 1 were located in areas potentially affected directly or indirectly by the project; therefore, these species will not be further analyzed. Sensitive species accounts for the species carried forward are included in Appendix A.

Table 2. Sensitive plant occurrences in the Somes Bar Project

Species	**Taxonomic Group**	**Number of Occurrences**	**Units**	**Prescription**
Buxbaumia viridis	Bryophyte	2	2403 2247	Manual, Prescribed Burn Manual, Prescribed Burn
Sulcaria badia	Lichen	3	2249 (2) 2268	Mechanical/Ground based/Prescribed Burn Prescribed Burn
Cypripedium fasciculatum	Vascular Plant	1	2162	Manual, Prescribed Burn
Thermopsis robusta	Vascular Plant	3	2454 2462 2461	Mechanical/Ground based/Prescribed Burn (existing landing) Mechanical/Cable /Prescribed Burn Mechanical/Ground based/Prescribed Burn (existing landing nearby)
Phaeocollybia olivaceae	Fungus	1	2161	Manual, Prescribed Burn

The following provides information on what is known or suspected about the biology and ecology of the species with relevance to the proposed activities and effects analysis that follows. Little if any information is known about management effects to a particular Sensitive species, therefore, species will at times be addressed in the context of their particular habit or taxonomic group.

Bryophytes/*Buxbaumia viridis*: While *Buxbaumia viridis* (BUVI) has a global distribution that includes northern Europe, in North America it is known to northern California. An estimated 12 occurrences exist on National Forests; two on the Six Rivers National Forest, within the project area.

Bryophytes lack the vascular system found in seed plants and therefore depend on their immediate surroundings for moisture and nutrients. The species reproduce sexually by releasing spores which are in turn, wind-dispersed. BUVI is an ephemeral species, out-competed by other bryophyte species. In addition it is considered dispersal limited. So availability of suitable habitat proximal to an existing plant is important.

BUVI occurs in mesic to moist settings and occupies well rotted (decay class 4 and 5) logs or other forms of coarse woody debris of high water content. Relative persistence at an occurrence is dependent upon suitable microclimate conditions and available substrate. In the project area, it was located advanced decay class logs associated with riparian settings. Of the two occurrences, only one sporophyte was detected at the new occurrence. The other occurrence was a known site from 2006 and not re-located. While not relocated upon revisiting in 2015, this species could be easily overlooked given its small stature (Figure 1). This is one of the 11 occurrences known from California. Conservation guidance for BUVI includes establishing a no-disturbance buffer, (action dependent), in which existing shade and large logs across age classes are maintained (Harpel and Hoover 2006).

Figure 1. ***Buxbaumia viridis*** capsule (see arrow) on an advanced decay class log. Somes Bar Project.

Fungi: The fungi species listed in Table 1 can be divided into three groups: saprobic, mycorrhizal and parasitic. *Sowerbyella rhenana* is saprobic meaning that they are decomposers, thriving on the litter and duff of the forest floor. Litter saprobes, such as these species, can extend over a large area, via mycelial networks. Relatively shady and moist to mesic mature stands with various sized litter (including some coarse woody debris) describe the habitat for saprobes. *Boletus pulcherrimus* and *Phaeocollybia olivaceae* are mycorrhizal. Mycorrhizal fungi form interdependent relationships with their host tree, exchanging nutrients, mineral and water. There is one known occurrence of *Phaeocollybia olivaceae*, detected in 2006 as a part of a fungi habitat modelling project (Hoover and O'Hanlon 2008). *Dendrocollybia racemosa* is parasitic on decaying

fungi. Common to all of these fungal groups are habitat conditions characterized by shady, mature stands with conifer or hardwood hosts and ample organic substrate (e.g. leaf, needle, woody debris). Networks of fungal hyphae or mycelia (the body of the fungus) group together into strands. These networks scavenge nutrients from the surrounding soils, acting as an extension to the root system. These hyphae can grow to infect nearby plant roots and can eventually connect neighboring plants. This network facilitates carbon transfer from the host to the fungus. Networks also facilitate water transfer (Bruns 1995).

Management that retains living trees (the host) and the important underground linkages for mycorrhizal fungi via the myceliel network will maintain habitat parameters for mycorrhizal species (Amaranthus and Perry 1994). Likewise, management that retains overstory canopy and the litter and coarse woody debris of the forest floor will maintain habitat parameters for saprobes (Norden et. al. 2004).

Lichens/*Sulcaria badia*: Geographically, *Sulcaria badia* (SUBA) is endemic to western North America, with fewer than 30 occurrences, of which approximately 19 are in California in association with the North Coast and Klamath geographic provinces. Six Rivers National Forest supports an estimated 50% of the California occurrences.

SUBA is a fruticose lichen that appears hairlike or bushy, hanging from the twigs of its substrate. Neither sexual nor asexual reproductive structures have been observed; therefore, SUBA presumably reproduces via fragmentation (Carlberg and Toren 2006). As the name implies, fragmentation is a form of reproduction whereby, the thallus (the body of the lichen), breaks or is torn by strong wind or animals, resulting in the dispersal of lichen fragments. Fragments can become entangles in the leaves, needles, twigs or branches of nearby trees or shrubs or fall onto the forest floor as litter. Reproduction by fragmentation may explain the species' relatively limited distribution of 7 general localities in California (some of which support multiple sites) (Carlberg and Toren 2006). Since the species is typically found by ground-based surveys, thalli in the upper canopy would not be detected; therefore, SUBA may be overlooked in such situations. Lacking substantiation of its distribution in the canopy, it is fair to say that the restriction to certain geographic locales is partially a result of limited dispersal capability.

Habitat for SUBA is described as well-lit plant communities (Brodo and Hawksworth 1977) and includes oak woodlands in the northern and southern portions of its range. Six Rivers is geographically situated toward the middle of its range and here SUBA was documented in mixed hardwood-Douglas-fir forests. The hardwood component was comprised of madrone, tanoak, black oak, canyon live oak and big-leaf maple, and ponderosa pine was an associating conifer.

Lichens exchange water and gases through their "skin" and thus are influenced by changes in atmospheric moisture. Generally speaking, lichens are most susceptible to changes in their environment when the thallus is hydrated. In this condition, lichens are most photosynthetically active, contrarily, no gas exchange occurs in air-dried lichens (Nash 1996). In California's Mediterranean climate, lichens are most actively growing during the rainy season extending from late fall to early spring. SUBA's position on the

moisture requirement gradient is not known, but given its habitat description ranging from well-lit plant communities and oak woodlands representing the dry end of the moisture gradient to conifer stand types representing the mesic end; it appears to tolerate a variation in moisture conditions.

Changes in atmospheric moisture and its effect on lichens are influenced by temperature. Lichens are well-adapted to temperatures experienced in their micro-habitat (Nash 1996), but tolerances to heat outside the natural range of variability can trigger a stress response in the lichen. In a dry state, lichens have a tremendous capacity to tolerate heat stress, but when hydrated that tolerance diminishes.

Vascular plant/*Cypripedium fasciculatum* (CYFA): This species range is relatively wide, occurring in eight western states. Review of the data covering the species range indicate that more than half of the occurrences documented have fewer than 10 plants (Kaye and Kramer 2005). On the Orleans/Ukonom Ranger District there are an estimated 6 occurrences. The last monitoring of most of the CYFA occurrences on Six Rivers was 2010; therefore, the current condition of the population on the Forest as a whole is unknown.

CYFA is associated with mature forests under relatively high canopy cover (e.g. 60%). Sufficient forest canopy cover and structure to provide shade and filtered light is important to the ecology of this species: adequate forest floor moisture and forest floor organics including logs are needed to sustain their mycorrhizal associates, adequate understory temperatures and humidity are needed for plant establishment and growth (Kaye and Kramer 2005). The one occurrence in the project area (consisting of a single plant) was under >60% canopy cover of tanoak and Douglas-fir, the latter, including sub-canopy trees and what appeared to be old-growth Douglas-fir trees (4' diameter-breast-height) nearby. The habitat was also characterized by a high litter/duff layer that included a large log.

Reproduction is through both seed development which is subsequently aerially dispersed and development from under-ground roots (rhizomes). Localized seed dispersal combined with occasional long-distance seed movement may contribute to the species patchy distribution (Kaye and Kramer 2005). Establishment at any one site is dependent on the previously mentioned habitat variables and the presence of mycorrhizal associates. While reproduction from seeds does occur, allowing for relatively long-distance dispersal, asexual reproduction through rhizome development is more common; thus expansion of the occurrence is very dependent upon the condition of the local occurrence.

CYFA is located in a unit that is proposed for manual thinning and clearing of small diameter ladder fuels and shrub species, applying similar prescription designs associated with the units where SUBA was located, including size of trees to be removed, retention of minimum residual canopy cover of 60% and hand piling of slash for subsequent burning.

Vascular plant/*Thermopsis robusta*: *Thermopsis robusta* (THRO) is bioregionally abundant and also considered endemic to the Mid-Klamath region. The occurrence total

is approximately 56 with an estimated 20 occurrences on the Orleans Ranger District and 19 on the Ukonom Ranger District, the remaining on other Districts of the Klamath National Forest.

THRO is in the legume family and like many legumes are considered pioneer species associated with early successional settings with little canopy cover and few competing species. Their seed being long-lived and their seed coat being hard, the species can become established after wildfire or other intense disturbances. This tolerance to disturbance is further evidenced by the occurrence of this species on roadsides, skid trails landings, and burned settings. Of the occurrences in the project area, one was along a road edge in association with the invasive, himilayan blackberry, and two were associated with existing landings.

V. ENVIROMENTAL EFFECTS

Indicators of effect for those Sensitive plants and fungi associated with this project are related primarily to proposed actions within mid-mature and older seral stands, specifically, the extent of overstory and sub-canopy removal, ground disturbance related to mechanical removal of trees, fire intensity, prescribed fire frequency within those mid-mature stands and older. Given the relatively small amount of new ground disturbance associated with new landings (13 acres) and new temp roads (0.6 miles), the environmental effects pertaining to these actions are considered nominal and therefore will not be addressed for those species associated with the mid-mature and older seral stages. The exception, as identified above, is *Thermopsis robusta*. This species responds positively to fire and can occupy settings resulting from mechanical disturbance, including landings, if plants within an occurrence are proximal to the disturbance site.

Table 1 displays the overlap of initial treatments with mid-mature and older stands and the proportion of the project area affected.

Table 1. Treatments by mid-mature and older seral stages

Treatment	**Acres by treatment**	**Acres overlapping mid-mature and older seral stages**	**Proportion of the project area by treatment in older seral stages**
Mechanical (ground or cable) & Mastication	1420	212	15%
Manual/Prescribed Burn	2658	905	34%
Understory Burn[3]	1491	721	48%
TOTAL	5570	1838	32%

[3] Understory burning acres overlap with other treatment areas

Direct and Indirect Effects to Sensitive Fungi

Surveys were not conducted for Sensitive fungi due to their ephemeral habit (existing underground, infrequent fruiting…) and the expected retention of habitat components important to most fungi across the units. Given that strategic fungi surveys in 2006 detected *Phaeocollybia olivaceae*, which occurs in Unit 2462 of the Ti Bar Focal Area, this site will be addressed separately.

Effects are discussed in light of the magnitude of changes in the habitat as a result of implementing the proposed action. Direct and indirect negative effects of these activities pertain to removal or severance of mycelial components (which comprise the fungal organism) residing in the organic or topsoil layer, reduction in canopy shade and organic forest floor cover, reduction in the abundance of host trees or shrubs that provide nutrients to the fungus via mycorrhizal networks and refuge species to sustain inoculum through periods of successional change in the stand, removal or reduction of forest floor organics and coarse woody debris which form the primary micro-habitat for saprobic species, and breakdown of soil structure (e.g. compaction) which not only affects the mycelia therein but also damages fine root tips to which the mycelia attach (Amaranthus et. al. 1996). The density of trees cut and the depth of the burn are important variables that would influence impacts to Sensitive fungi. As an example, ectomycorrhizal (ECM) fungi such as *Phaeocollybia olivaceae*, can survive in the roots of host trees that are retained in a stand (Dahlberg et al. 2000). In regards to the spatial scale of disturbance as well as intensity, the mycelial network underground for a given ECM fungus can extend from 1.5 to 27 meters, therefore; disturbance at a given site may not impact the complete fungal organism (Dalhberg and Stenlid 1995).

Relative to burning, negative effects to any of the Sensitive fungi increase with intensity and frequency. Relative to intensity, while low intensity prescribed burning appears to have only a slight effect on ECM fungal communities and propagules (Bastias et al. 2006), burning off the organic material to the mineral soil layer removes resources for litter saprobes and can damage mycorrhizal networks in the litter and top mineral layer. Tolerance of ECM fungi to soil heating does vary by species. Soil heating has been shown to affect fungi species when the temperature reaches 60 to 70 degrees; yet some fungi species survived heating at this level (Kipfer, T. et al. 2010).

Frequent burning does not allow for development of the organic layer (Dahlberg et al. 2000). Frequency can also have a similar effect whereby repeated burning does not allow for accumulation of organic material on the forest floor and therefore, can significantly reduce below-ground EMC fungal biomass (Hart et al. 2005, Tuininga and Dighton 2004, Wiensczyk 2002). Contrarily, an extended period beyond the natural fire return interval, creates a fuel layer that can increase the risk of forest floor burning intensity and depth of burning.

Mechanical Treatments (approximately 25% of the project area)
In light of the potential direct and indirect effects identified above, the following elements are included in the prescriptions for mechanical treatments, with follow-up

manual treatment (thinning, burning) as necessary and would serve to reduce direct and indirect effects to Sensitive fungi associated with mature forests. The prescriptions include:

- maintenance of 40-60% residual canopy cover
- retention of all pre-dominant trees
- establishment of retention areas through a given unit covering 5-10% of unit in 0.25-1.0 acre sections
- thinning only those area of a unit identified as having unacceptably high fuel loading which could lead to negative prescribed fire effects.

Manual Treatments (approximately 48% of the project area)

For those units in mature forests that are proposed for manual treatments only (thinning and burning), imperative to these treatments is the over-riding goal to break up fuel continuity focusing on areas identified as having an unacceptably high fuel loading which would increase the risk of negative prescribed fire effects (e.g. high intensity, crown fires). Specific attributes of the prescription that would serve to reduce direct and indirect effects to Sensitive fungi include:

- maintenance of 60% residual canopy cover
- establishment of retention areas through a given unit covering 5-10% of unit in 0.25-1.0 acre sections
- burn return interval in mature stands is conservatively estimated at 5-7 years and not expected to result in complete removal of organic material on the forest floor.

The establishment of retention areas within a stand could also reduce the potential effects to fungi in a given unit pertaining to incidental departures from low intensity burns and burn frequency. Furthermore, for all proposed actions, Standards and Guidelines from the Klamath National Forest Plan (USDA/USFS 2010) and Soil Quality Standards from Six Rivers National Forest (USDA/USFS 1995) that pertain to coarse woody debris (CWD) and soil productivity also address habitat components that are critical to Sensitive fungi, specifically:

- Biological Environment (6-16)-protect CWD from burning and yarding… and other activities that might otherwise destroy the substrate, retain CWD in forest patches…(USDA/USFS 2010)
- Soil Productivity (3-4)-a minimum of 50% of the soil surface should be covered by fine organic matter following project implementation, if it is available on the site. (USDA/USFS 2010).
- Retain litter and duff over 50% of the activity area (LRMP, Appendix L-1) (USDA 1995)
- Retain existing course wood debris as a source of organic matter, when occurring…at least 5 logs per acre, giving preference to those logs 20 inches in diameter and in decomposition classes 3 through 5 (LRMP, Appendix L-1) (USDA 1995).

In the specific case of the known occurrence of *Phaeocollybia olivaceae* in Unit 2462, pile burning is a component of the manual fuels reduction objective for this unit. Given

the variable responses of ECM fungi such as *Phaeocollybia olivaceae* to soil heating (Kipfer et al. 2010), a buffer was established in which "lop and scatter"- the spreading of thinned small trees and shrubs—could occur in lieu of pile burning within a buffer.

Understory Burning (approximately 27% of the project area)
Where coincident with mature and older stands, the application of understory burning treatments would give consideration to existing conditions to ensure that burn intensity would result in low to moderate fire effects overall with isolated pockets of higher fire effects. The prescription provides for an option to manually thin and hand pile or lop and scatter fuels prior to reintroducing managed fire in order to reduce the risk of negative prescribed fire effects. General guidelines also include that once understory burning has occurred on a unit, burn frequency will depend on conditions such as fuel loading, aspect and habitat types.

As identified in the introductory paragraph, repeated prescribed burning at frequent burn intervals over a given area has been documented to negatively affect fungi species, specifically, consumption of the below-ground mycorrhizal biomass, which in turn affects the ecology of the forest (Hart et. al. 2005). Concern related to the direct and indirect effect of prescribed burn interval is mitigated somewhat by existing Standards and Guidelines on both Forests and Soil Quality Standards on the Six Rivers National Forest applicable to the Donahue Focal Area, which are outlined above under Manual Treatments.

Clearings for landings will not maintain any habitat components for Sensitive fungi. If present, Sensitive fungi will likely be extirpated from areas directly impacted by construction of new landings. Areas proposed for narrow fire return intervals (e.g. 2 or 3 years) in portions of understory burning units that may overlap with mature forest may also result in direct and indirect effects to Sensitive fungi species; these effects may be mitigated by establishing retention areas.

While not eliminating effects to fungi, it is assumed by managing for habitat elements in thinning, manual burning and understory burning as described under the respective prescriptions and the application of Forest Standard and Guidelines as well as Soil Quality Standards that adverse effects on ECM and saprobic communities can be reduced. Effects of relatively small scale activities are not likely to significantly reduce the fungal species diversity that was in place prior to the disturbance (Durall et al. 1999, Hagerman et al. 1999). In certain areas in a stand, micro-habitat features would be impacted by skidding, felling of canopy trees, yarding tops, end-lining or pile burning, but mycelial networks can extend several meters through the forest floor, so conceivably localized impacts may impact or sever part of the fungal individual but would not necessarily impact the entire body of the organism. Furthermore, if vegetative and soil conditions are retained in places within the unit, spores stored in the soil provide a propagule for development of fungi after the disturbance. These impacted areas will recover in time and along with it the development of fungal communities (Dahlberg and Stenlid 1995).

Direct and Indirect Effects to *Buxbaumia viridis*

Buxbaumia was associated with advanced decay class logs in a riparian setting of a mature forested stand. Direct and indirect effects are those that remove occupied and suitable substrate in the vicinity and alter micro-climatic conditions around the occupied substrate. Manual removal of fuels and prescribed burning are the activities proposed in the units that support *Buxbaumia* occurrences. Riparian reserve locations of these occurrences afford protection from mechanical removal, skidding etc. but intensity related to burning and potential pile burning is of concern. Evaluation of ladder fuels and stems per acre—indicators of fire intensity—was conducted for those units that support *Buxbaumia*. Results indicated that for one occurrence, both indicators ranked of low concern, for the other ladder fuels ranked of moderate concern to moderate and high for stem density.

In light of the concern for one occurrence coupled with the extremely limited distribution of this species overall, a project design features incorporates a buffer at both *Buxbaumia* occurrences of approximately 50' x 25'. These buffered area would be considered "retention areas" as defined in the prescription that includes inner riparian reserves and occurrences of Forest Sensitive species. Within these buffered/retention areas manual thinning would occur to ensure subsequent prescribed burning intensity would be low. Slash resulting from the thinning would be piled and subsequently burned outside the buffer to further reduce the chance of "hot spots" within the buffer. In keeping with the attribute identified above for Sensitive fungi, the prescribed burning interval in these units is estimated at 5 to 7 years and like the initial burn, would be designed for a low intensity treatment.

In addition to establishment of a buffer/retention area, stand-level prescriptions outlined above under the Sensitive fungi section (e.g. retention of 40-60% residual canopy cover, burn intervals greater than 5 years) and standards and guidelines (i.e for CWD and retention of advanced decay class logs) would further reduce the potential for direct or indirect effects to *Buxbaumia viridis*.

Direct and Indirect Effects to *Sulcaria badia*

Sulcaria badia (SUBA) was found as litterfall or attached to twigs in unit 2249 (mechanical/ground based/prescribed burn) and 2268 (understory burn). Direct and effects are those that remove the primary substrate for the species. Indirect effects pertain to changes in atmospheric condition during a time when the lichen is actively growing (i.e. wet season) and isolation of the "parent" trees from other potential substrate in the understory.

In both units, the substrate was assumed to be the closest mature trees to the thalli found as litter or on understory trees. To alleviate direct effects to *Sulcaria*, a buffer was

flagged in both units that incorporated all the mature trees that surrounded the thalli. Buffer diameters range from 25' to 50' radius. Relative to the buffers,

Unit 2249: mechanical

- small diameter stems considered fuels would be thinned to ensure a low intensity prescribed burn as a follow-up treatment; no commercial products shall be removed from within the buffers; directionally fell trees away from the buffers
- incorporate the buffers into retention areas as described in the prescription for mechanical units

Unit 2268: understory burn

- before burning, thin small diameter stems and shrubs within the buffer prior to reintroducing fire to best ensure a low intensity understory burn,
- locate slash and burn piles outside of the buffer,
- burn return interval in area of the unit with the buffer shall occur at no less than 5-7 years .

Direct effects of the mechanical treatment are alleviated by the establishment of a buffer that would retain mature canopy trees—likely the source of the *Sulcaria* found in the understory. In addition features such as retention of 40-60% overstory and subcanopy trees and predominant trees, as well establishment of retention areas in mechanical units that incorporate occurrences of Sensitive species will reduce concerns for both direct and indirect effects to *Sulcaria badia.* No direct effects are anticipated as a result of understory burning in Unit 2268.

Manual thinning followed by prescribed burning and understory burning would constitute potential indirect effects by changing atmospheric conditions in the short term during a season of year when the lichen is most actively growing. In the case of the former, material thinned from within the buffer would be located beyond the buffer's perimeter. Piles would be covered and burned in the fall/winter. In the case of the understory burning, burn frequency is estimated at 2 to 7 year intervals. Burning at the narrow end of the spectrum, during the season when lichens are hydrated could result in negative indirect effects to *Sulcaria* depending on its location in the canopy and distribution across a given stand, as fire behavior/smoke generation is not likely to be uniform given the topography of the landscape. Given this concern, understory burning at an interval no less than 5 years will aim to reduce indirect effects to this species.

Direct and Indirect Effects to *Cypripedium fasciculatum*

Similar in general habitat requirements as the Sensitive fungi, *Buxbaumia* and *Sulcaria*, *Cypripedium fasciculatum* is associated with mature forests and given that it is a mycorrhizal species, those habitat attributes that benefit fungi, also benefit *Cypripedium* (e.g. CWD, organic material on the forest floor, shade).

Cypripedium was located in a manual/burn unit. Direct effects are those that remove or damage the plant(s) associated with the occurrence. Damage can be in the form of burning of the plant during the spring of the year, whereby, lost tissue cannot be replaced until the following year which in turn leads to a set-back in flower production and thus seed production (Kaye and Cramer 2005). Indirect effects are those that remove host species and remove or isolate the occurrence from suitable habitat needed for dispersal.

Elements of the prescriptions identified for other Sensitive species above, such as reducing the potential for negative wildfire effects, maintenance of 60% residual canopy cover as a part of the prescription as well as the establishment of retention areas that include Sensitive species, would reduce both direct and indirect effects to this species. A concern with the current condition relates to the ladder fuels in the vicinity of the *Cypripedium* occurrence. Assessment of ladder fuels and stems per acre for the unit with the *Cypripedium* occurrence indicated a low to moderate concern relative to ladder fuels and a low concern for stem density. In light of the moderate concern for ladder fuels influencing fire intensity, a buffer/retention area (25' diameter) was established around the occurrence. Within the buffer/retention area, thinning of small diameter trees and shrubs would occur and fuels generated from this activity would be piled for burning outside of the buffer. This initial thinning and exclusion of pile burns would best provide for the initial prescribed burning which is designed for low intensity fires. For prescribed burning, the burn design would incorporate fall/winter burning only in the area that includes the buffer. With the buffer and prescription design in place, similar to *Buxbaumia,* direct effects of implementing manual treatments would not be expected.

Burning frequency could be a concern for this species. Akin to fungi, the prescribed burning interval after thinning and the initial burn could alter habitat attributes upon which *Cypripedium* depends such as adequate forest floor moisture and forest floor organics including logs to sustain their mycorrhizal associates. A narrow burn interval in the habitat setting supporting *Cypripedium* could result indirect effects by altering forest floor conditions upon which this species depends; therefore the project design feature relative to a fire return interval of 5 to 7 years would apply to the buffer to reduce indirect effects.

Prescription objectives for manual burns (e.g. low intensity, fire return interval), prescription features (e.g. residual canopy cover of 60%), Standards and Guidelines for soils and CWD, and the establishment of a buffer/retention area that includes thinning and excludes pile burning would reduce if not alleviate concerns for both direct and indirect effects to *Cypripedium fasciculatum.*

Direct and Indirect Effects to *Thermopsis robusta*

Thermopsis robusta is an early seral stage species—preferring open habitats that are subject to relatively frequent disturbance. *Thermopsis* is a disturbance "follower" evidenced by its spread along road prisms or in the wake of burning.

Direct impacts are those that physically remove all the plants and substrate (i.e. top layer of the soil) at a given location which can happen in relation to landing development. However, if some plants are not affected in proximity to the landing or the top layer of the soil is not removed, *Thermopsis* can survive, regenerate from the seed bank and become established in the disturbed area. This is evidenced by the coincidence of *Thermopsis* with existing landings in the Donahue Focal Area. In the case of the existing landings, a project design feature for occurrences corresponding to existing landings next to Units 2454 and 2461 in the Donahue Focal Area, is the buffering or retention of *Thermopsis* plants that occur on the edge of the existing opening. These retained plants would provide a seed source that could germinate on the newly disturbed ground.

Indirect effects of ground disturbance or pile burning adjacent to *Thermopsis robusta* are considered beneficial to this species. Disturbance near an occurrence can create suitable habitat for *Thermopsis robusta* seed dispersal and establishment. An exception in the case of one occurrence of *Thermopsis* is its association with himilayan blackberry along a road edge adjacent to a mechanical cable unit 2462. Disturbance associated with cable logging may lead to a spread of himilayan blackberry which exists here as a relatively discrete site. As an early seral species that prefers open habitat, *Thermopsis* does not compete well and could be overtaken by the blackberry. To reduce the potential for indirect effects, a small buffer (25' x 15') was established to exclude activities related to mechanical/cable thinning. The buffer would not apply to subsequent prescribed burning.

Cumulative Effects

For this project, the spatial context for cumulative effects analysis is at the local scale since this is the appropriate scale of a population (plant and fungal). A population is the fundamental biological unit for a species. It is at this unit that effects are most readily detected. While consideration is given to the status of a species across its range and the planning unit (i.e. Forest) when assessing cumulative effects, detailed analysis of effects for rare taxa beyond the local scale is not often biologically meaningful due to variables associated with particular activities and varying (and often unknown) thresholds of a species to disturbance. In the case of this project, the local scale spatially incorporates past, present and foreseeable activities or events on public and private land that are across the focal areas.

In keeping with the spatial scale, the temporal context for assessing past activities would coincide generally with those actions that occurred prior to development of land management plans for National Forests which included management of rare species and those activities that were subject to rare species management under respective Forest Plans. The foreseeable future activities are associated with implementation of Orleans Community Fuels Reduction Project (OCFR), Roots and Shoots Fire Management Project and the Aquatic Restoration project.

<u>Past Actions</u>

Across the focal areas, there are an estimated 1,482 acres of plantation, clear-cut prior to the 1980s. It can be assumed that any of the target species associated with these clear cut areas are no longer extant. Private land constitutes approximately 800 acres. While not applicable to all private lands, it is assumed that developments associated with private property whether it included logging, building construction, or other clearings likewise altered habitat conditions to the detriment of the Sensitive plant species, *Buxbaumia viridis*, *Cypripedium fasciculatum*, and *Sulcaria badia* and Sensitive fungi species *Phaeocollybia olivaceae*. The extent and intensity of habitat alteration and clearing may also have affected the early successional species *Thermopsis robusta* by complete removal of occurrences in the wake of logging, but given the variation of disturbance intensity, type of disturbance (mechanical versus fire) and proximity of disturbance to an occurrence, the variables are too broad to comment on past actions to this species.

Distribution of the species addressed in this document was little known on National Forest lands until after the 1980s in association with the development of Forest land management plans and correspondingly rare species which tended to focus on vascular plants (e.g. *Cypripedium fasciculatum*). Attention to non-vascular and fungi species (e.g. *Buxbaumia viridis*, *Phaeocollybia olivaceae*) was in association with the Northwest Forest Plan' Standards and Guidelines which required management of what are called "Survey and Manage" species (vascular, non-vascular, fungi, mollusks) that are associated with late successional forests (USDA/USDI 1994). Past projects in the focal areas that coincide with the introduction of land management plans and the Northwest Forest Plan include the Orleans Community Fuels Reduction Project (OCFR) and Roots and Shoots Prescribed Fire Project (RS).

For both of these projects, surveys were conducted in potential habitat for Sensitive plant species; however, between 2006 and today, the Sensitive plant list has changed. The species analyzed in this document that were Sensitive in 2006 are *Cypripedium fascicultum*, *Buxbaumia viridis* and *Phaeocollybia olivaceae* (as well as the three other fungi listed in Table 1). *Sulcaria badia* was not added to the Regional Sensitive species list until the end of 2013; therefore, was not considered during analysis of OCFR.

Relative to OCFR, of the species detected during surveys, *Buxbaumia viridis*, *Sulcaria badia* and *Thermopsis robusta* were the three that are associated with the current project. Management of *Buxbaumia* was linked to its presence in riparian reserves, prescription design that would retain 60% canopy cover across stands, as well as Standards and Guidelines pertaining to soil productivity and coarse woody debris. For *Sulcaria*, a no disturbance buffer was established that included a perimeter of mature Douglas-fir trees and the retention of canopy cover was also factored in to reducing indirect effects for this species. For *Thermopsis,* all occurrences were flagged to avoid disturbance with the exception of one occurrence associated with a landing; impact to that occurrence was disclosed. Sensitive fungi were addressed in OCFR similarly to the current project; in that surveys were not conducted due to their ephemeral habit, underground mycelial network and the expected retention of habitat components important to most fungi across the unit in a mature seral stage. With the restrictions on activities in riparian reserves germane and associated land management standards and guidelines germane to

Buxbaumia, no disturbance buffer for *Sulcaria*, and the prescription design to retain 60% canopy closure, no direct or indirect effects were anticipated for these species. Loss of occurrences were possible in relation to *Thermopsis* and Sensitive fungi but not to the extent that population viability would be of concern. Details relative Sensitive species can be found in the Biological Assessment/Biological Evaluation for (Hoover 2008).

Relative to Roots to Shoots (RS), of the Sensitive species, only *Phaeocollybia olivaceae* was known to the project area. Given the nature of the project with it's a) focus on prescribed burning designed for low-intensity fire to promote culturally significant plant species (e.g. hazel, *Corylus cornuta*) and if present, also *Thermopsis robusta*; b) a burning interval associated with the *Phaeocollybia* of no less than 2 years; c) the project's use of manual techniques for thinning fuels; and d) application of soil standards and guidelines pertaining to retention of coarse woody debris and ground cover, it was expected that this project would not result in any negative effects to Sensitive species and thus, surveys were not conducted. Details relative analysis of Sensitive species can be found in the Biological Assessment/Biological Evaluation for RS (Hoover and Kenfield 2015).

In regards to the 2017 Marble Wildfire, of the focal areas within the project, only Patterson was affected by this fire which burned 318 acres. The majority of the 318 acres burned at relatively low intensity and of the high intensity areas, they were primarily comprised of vegetation in the early mature or shrub seral stages. Surveys of those mid-mature and older stands within the fire perimeter in 2015, prior to the wildfire, did not result in any detections of Sensitive species; therefore, the effects of this wildfire event on the target species is considered minimal to non-existent.

Foreseeable Future Actions

These future actions would be associated with continued implementation of OCFR, RS (discussed above), implementation of the current project (effects addressed in this analysis) and it is anticipated that the Aquatics Restoration Project will also be in place. The latter is a Forest-Wide Programmatic that includes such actions as instream habitat management and riparian vegetation restoration. Prior to design and on-the-ground implementation, the programmatic requires the involvement of resource specialists to determine if project design features are needed to reduce negative effects. In the case of Sensitive plants and fungi species, botanical staff would review the project relative to potential to effect Sensitive plants and fungi species or their equivalent, implement surveys during the appropriate season as necessary and determine if alterations to the proposed action are needed.

Summary

In summary, actions that resulted in the clear-cutting of mature and older forests during the 1960s-1980s likely affected those rare plant and fungi species associated with this habitat. With the exception of *Cypripedium fasciculatum*, these actions were implemented prior to our knowledge about the occurrence of the other species on the respective Forests; nonetheless, presence of one or more of these species was likely.

Recent past actions (1995 and later) and foreseeable future actions are guided by the respective Forest Plans and associated Standards and Guidelines that address Sensitive species (or their equivalent, Species of Special Concern, in future Forest planning efforts). Project design features associated with past, present and future projects (OCFR, RS, Aquatic Restoration Project and the current project) are intended to reduce the possibility of direct effects to rare species and mitigate significant indirect effects and yet there are inherent uncertainties when addressing fungi and certain vascular and non-vascular species. Specifically, in light of their habit and habitat, direct effects may occur to Sensitive species that are missed during surveys: a) the "body" of fungi species being underground and connected by mycelia, b) *Sulcaria badia*'s occupancy of tree crowns that go undetected during ground-based surveys c) the potential of *Cypripedium fasciculatum* plants in an occurrence to be dormant for one or two years, and d) *Buxbaumia viridis*'s extremely small stature.

IV. DETERMINATION

It is my determination that with the aforementioned prescriptions, Standards and Guidelines and project design features, the Somes Bar Integrated Fire Management Project implementation will not negatively direct or indirectly affect the documented occurrences of *Thermopsis robusta*.

For *Buxbaumia viridis* and *Cypripedium fasciculatum*, with the prescriptions, Standards and Guidelines and project design features, project implementation will not directly affect the species but may result in indirect effects due to variables associated with burning and buffer dimensions (e.g. too small to accommodate fire variables). Implementation of the Somes Bar Integrated Fire Management Project may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for *Buxbaumia viridis* and *Cypripedium fasciculatum.*

While specific sites exist for one Sensitive fungus, *Phaeocollybia olivaceae* and *Sulcaria badia*, there is potential for other fungi occurrences as well as occurrences of *Sulcaria* in the canopy of mature trees that were not detected via ground-based surveys. Without specific occurrence information, it is my determination that with the aforementioned prescriptions and Standards and Guidelines that implementation of the Somes Bar Integrated Fire Management Project may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for *Sulcaria badia*, *Boletus pulcherrimus*, *Dendrocollybia racemosa, Phaeocollybia olivacea,* or *Sowerbyella rhenana.*

Signature: /s/ *Lisa D. Hoover* *December 13, 2017*
Forest Botanist Date

Appendix A. Species Accounts

Boletus pulcherrimus

Boletus pulcherrimus is endemic to the Pacific Northwest from Washington south to central California, and in California extends east to the Sierra Nevada (Castellano *et al.* 1999, USDA 2005). There are 12 documented occurrences in California. Three of these occur on National Forest lands, one each on Six Rivers and Klamath NFs, and two on Shasta-Trinity NF (USDA 2005). Habitat for *Boletus pulcherrimus* is broadly characterized as Douglas-fir with hardwoods (e.g. tanoak). It is an ectomycorrhizal (ECM) fungus that develops an interdependent relationship with living host species whereby the fungus obtains carbohydrates from the host plant and the host plant obtains mineral nutrients and water from the fungus. The underground fungal tissue (*mycelium*) is the network along which this transport of carbohydrates, mineral nutrients and water occurs. The host for ECM fungi is commonly in the Pinaceae. Host specificity beyond this broad category is not known.

Buxbaumia viridis

Buxbaumia viridis **(**BUVI2) is known from Europe, Scandinavia and Russia. In North America it occurs in British Columbia, Pacific Northwest, Idaho, Montana and south into California where it reaches the edge of its range in the northern Sierra Nevadas. On Federal lands in California, it is located on the Six Rivers, Shasta-Trinity, Modoc, Plumas and Rogue-Siskiyou National Forests. While geographically wide ranging, BUVI2 occurrences are highly disjunct.

There are 9 occurrences of BUVI2 in the state and one historical record in Mendocino County on state lands. The species is never abundant when found, often only one or two sporophytes may be present.

In California, BUVI2 has been found in mixed conifer stands dominated by white fir; in mid-mature Douglas-fir-Big leaf maple association with Pacific dogwood in the understory, and in old-growth Douglas-fir in a riparian area with Pacific yew and white alder. Its substrate is well-decayed (class 4 and 5) logs on peaty or humus soils.

BUVI2 is afforded some protection from management actions by virtue of its substrate being advanced decay class logs which are typically retained in a stand as directed by Standards and Guidelines and its habitat being moist to wet coinciding with riparian features which are also protected. The availability and recruitment of downed logs is important to the persistence of this species in a forest.

A conservation assessment document exists for this species**:** Harpel, J.A. and L. D. Hoover (2006).

Cypripedium fasciculatum

Cypripedium fasciculatum (CYFA) is known from eight states: California, Colorado, Idaho, Montana, Utah, Oregon, Washington and Wyoming. In California CYFA is known from Del Norte County to Sierra County. On Federal lands in California, the species is

known from the Six Rivers, Shasta-Trinity, Klamath, Mendocino, Lassen, Plumas and Tahoe National Forests.

On Six Rivers, of the 16 records of CYFA, only 9 were extant as a result of monitoring in 2010. Where detected, occurrence sizes were less than previously documented; no overt impacts were recorded. On the Klamath National Forest, which supports most of the occurrences in the species range, these occurrences have not been monitored in the last 20 years, at that time 7 occurrences were no longer present. The few occurrences on other Forests were extant in the early 2000s but there is little current monitoring that has occurred.

In general habitat for this species is Douglas-fir or mixed conifer forest of mid-late seral stages; stand structure that allows for some light to reach the forest floor. Occurrences have been documented in riparian areas. Mycorrhizal fungi play a pivotal role in the biology of this orchid, especially at early stages of development.

Given the reproductive and establishment complexity of this species and the associated relationship with mycorrhizal fungi, micro-habitat variables (availability of light, soil acidity) appear to be important; therefore the micro-habitat where these populations occur is considered fragile.

A conservation assessment was written in 2005 which summarizes information about the species across National Forests in California (Kaye and Cramer 2005).

Dendrocollybia racemosa

Dendrocollybia racemosa occurs in Washington, Oregon and California east to the Sierra Nevada and south to the North San Francisco Bay area. There are 32 occurrences scattered throughout the California area, with one in the Lake Tahoe Basin Management Unit, two on Tahoe NF, one on Shasta-Trinity NF, two on Klamath NF, and six on Six Rivers NF. Habitat characteristics are very general. *Dendrocollybia racemosa* is parasitic on other fungi, drawing its nutrients from these hosts (Castellano *et al.* 2003). Its habit is gregarious.

Phaeocollybia olivacea

Phaeocollybia olivacea is known from Washington, Oregon and California where it has been documented as far south as the Sierra Nevada and the Central Coast Range (Castellano *et al.* 1999, USDA 2005). There are 40 documented occurrences in California, the majority of which are on the coastal plain. There are three documented occurrence on Six Rivers, five on Klamath NF, four on Shasta-Trinity NF, two each on Tahoe and Plumas NFs, and one at Castle Crags State Park on Interstate 5. Habitat for *Phaeocollybia olivacea* is generally characterized as conifer and hardwood forests where it can grow in arcs in the humus layer. See description above for *Boletus pulcherrimus* in regards to ECM functional group.

Sowerbyella rhenana

Sowerbyella rhenana is known from Washington, Oregon and as far south in California as Santa Cruz County (Castellano *et al.* 1999, USDA 2005). There are 20 documented occurrence in California (USDA 2005). Two are on Six Rivers NF near Big Flat Campground in Del Norte County. There are also two on Shasta-Trinity NF, and a tightly-grouped cluster of five on Klamath NF. Habitat for *Sowerbyella rhenana* is generally characterized as coniferous forests. It occurs on the forest floor in association with moist duff/humus and litter debris. *Sowerbyella rhenana* feeds on dead decaying organic material with the potential for an extensive underground mycelial network and fruits in scattered to gregarious groups.

Sulcaria badia

Sulcaria badia is a rare lichen endemic to western North America, restricted to areas of oceanic influence. It is currently known from only 13 occurrences in the world, ranging from central Oregon to Lake Pillsbury in northern California. Ten of these occurrences are in California (Carlberg & Toren 2006), and five fall onto National Forest lands; three on Six Rivers NF and one on Mendocino NF at Lake Pillsbury, composed of nine subsites (Toren 2004; Nilles & Toren 2003). Habitat for *Sulcaria badia* is described as "on trees, especially apple and oak trees, in well-lighted *Quercus garryana* communities" (Brodo & Hawksworth 1977; Peterson *et al.* 1998). The Oregon and the Lake Pillsbury occurrences are oak woodland habitats. The Six Rivers sites are mesic mixed hardwood/*Pseudotsuga menziesii* forests, with additional hardwoods (*Quercus kelloggii*) and scattered old-growth Douglas-firs. Threats include any activity that would cause the loss of a substrate tree, or activities that cause direct adverse impacts to the lichen, e.g. underburns with flame heights that burn lichens on branch ends.

Thermopsis robusta

Thermopsis robusta (THRO4) was previously known from 12 occurrences in California in Humboldt and Siskiyou Counties. Oregon occurrences recorded in 1893 presumed to be in California, not Oregon. Occurrence information derived from *Systematic Treatment of Thermopsis* by Chen and Turner.

There are 7 to 10 occurrences on Six Rivers NF, totaling,100 plants. The species is located in the Bluff, Slate, Camp, Wilson, Rosalena and Mud Creek watersheds on the Orleans Ranger District. There are 13 occurrences on Klamath NF, Ukonom and Happy Camp Ranger Districts, ranging in size from 5 to 50 plants, totaling approximately 300 plants. Species can be locally abundant.

THRO4 is an early seral species, occupied setting subject to disturbance including road banks and other clearings. When in a forest setting it occurs in openings of Douglas-fir dominated and mixed evergreen forests.

All known occurrences on the Six Rivers NF are within disturbed settings (e.g. road banks, old landings) within a Late-Succession Reserve (LSR) land allocation. Klamath NF locations are within matrix (timber management) allocations.

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